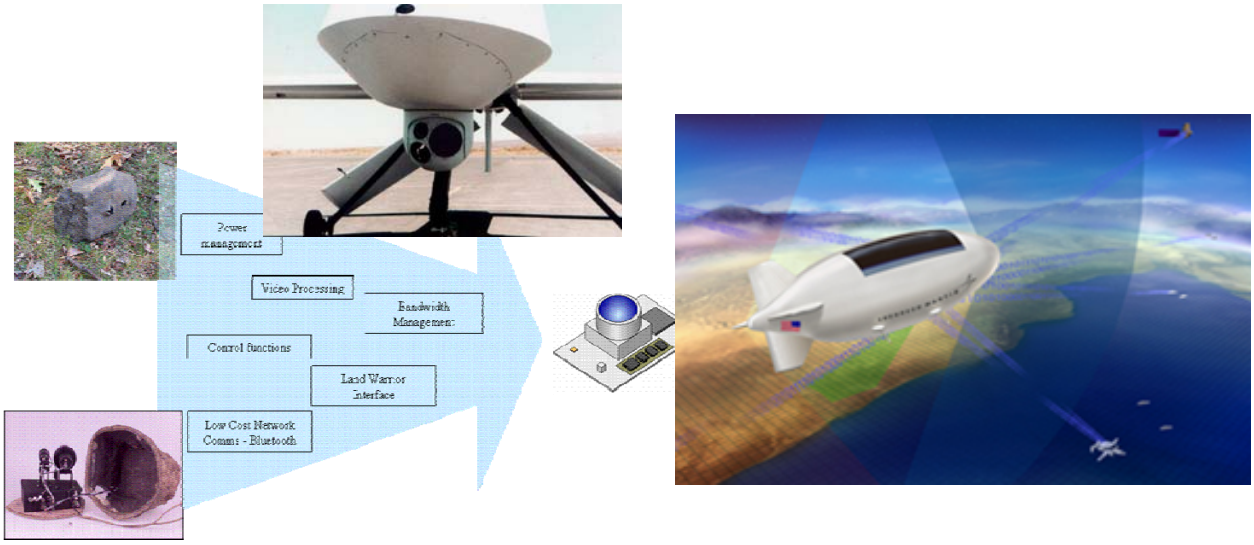
Collaborative Point Paper

On

Border Surveillance Technology



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NORTH AMERICAN TECHNOLOGY AND INDUSTRIAL BASE ORGANIZATION

NATIBO Collaborative Point Paper
on
Border Surveillance Technology

1. **Introduction –** The North American Technology and Industrial Base Organization (NATIBO) fosters cooperative planning for technology and industrial base program development among and between the Defense Departments of the U.S. and Canada. The NATIBO objectives are to:

   - Promote the development, administration, communication, and execution of the U.S. Department of Defense (DoD) and Canadian Department of National Defence (DND) technology and industrial base programs and policies.
   - Foster cooperation between the Governments of the United States and Canada in development of coordinated technology and industrial base policies and programs.
   - Leverage resources through cost sharing and economies of scale afforded through coordinated studies and projects involving research, development, industrial capability, and logistics programs.
   - Promote the exchange of technology and industrial base data between Canada and the U.S., the military services, other government agencies, and industry.
   - Promote coordination of technology and industrial base planning and insertion programs undertaken by the responsible U.S. and Canadian departments and agencies in support of their national security responsibilities.
   - Ensure that North American technology and industrial base considerations are taken into account during U.S. or Canadian military and/or civilian emergency planning activities.
   - Enhance the national security of both nations by promoting the competitiveness of the North American technology and industrial base.

   A Memorandum of Understanding (MOU) between DoD and DND for North American Technology and Industrial Base (NATIB) Activities was signed on 30 May 2001. The MOU is an umbrella document that covers research, development, technical demonstration and technology insertion activity in the two Defense Departments. The MOU allows three basic activities: Information Exchange, the creation of Working Groups, and formal Project Arrangements (PAs). The MOU provides a legal framework for which funds can be transferred between the participants in support of NATIBO studies and projects.

2. **Definitions and Acronyms.**

   Definitions:
   Platform: For purposes of this study, the platforms of interest are small non-combat aircraft (manned and unmanned), aerostats, fixed and mobile ground systems, and maritime systems (excluding warships). Satellite systems are not included in this study.
   Attended: Surveillance systems requiring manned crews 24/7 to operate and maintain. This includes UAVs and/or robotic systems that require remote control operators.
   Unattended: Surveillance systems that require only minimal manpower support in terms of periodic maintenance.
   Related Areas: Force Protection, Perimeter Defense.

Acronyms:

MOU	Memorandum of Understanding
NATIBO	North American Technology and Industrial Base Organization
PA	Project Arrangement
R&D	Research and Development
TOR	Terms of Reference

Background. Controlling movement across national borders presents numerous political, economic and technical challenges. While primary responsibility for border control rests with the US Department of Homeland Security (DHS) and Public Safety and Emergency Preparedness Canada (PSEPC), the respective defense departments have both key roles and significant materiel resources with which to support national security objectives. Given the size and in many cases remoteness of North American borders, technical solutions are necessary to act as multipliers to limited manpower within government enforcement agencies. The products and technologies to tackle this effort reside not only in the private sector, but in capabilities either under development or already in use by the military. Civil agencies can benefit from leveraging these capabilities if hurdles such as cost, training, interoperability and security can be overcome.

3. **Purpose.** The purpose of a collaborative point paper is to: (1) provide information regarding a subject of interest to both defense departments, (2) identify on-going technology and procurement activities within that subject area, (3) identify subject matter experts and organizational representatives in both departments with responsibility for the subject area, and (4) advocate collaboration using either the NATIBO MOU or another appropriate agreement. The point paper uses, in part, the format for a NATIBO working group Terms of Reference (TOR) document to facilitate the establishment of a formal working group under the MOU.

4. **Objectives.** The primary objective is to establish collaborative efforts on Border Surveillance technologies, system development, demonstration/test, and deployment concepts. The collaboration could include, but not be limited to, studies on technologies or requirements, joint research initiatives, technology transfer/insertion demonstrations, component testing or operational concept development. The scope of technologies/industrial base capabilities involved include those listed below (those highlighted in blue are discussed in this paper). A separate technology assessment of robotics is planned later in FY07.

Environment	PLATFORMS		SENSORS	
	Fixed	Mobile	Attended	Unattended
Land-Based	Towers, Barriers	Van/Truck, Robotic	Radar, Infrared, Electro-Optic, Video (Active systems)	CCD, Motion, Acoustic (Passive systems)
Airborne	Aerostats	UAVs, Rotocraft, General Aviation Aircraft		
Maritime	At-Sea Platforms, Bouys	Coastal Patrol Craft		

The NATIBO website can be used as an initial reference source: www.acq.osd.mil/ott/natibo/ In addition, members of the NATIBO Business Development Working Group can be contacted for assistance:

NATIBO Secretariat: Ms Jo Ann Carmichael U.S. Army, Edgewood Chemical Biological Center ATTN: AMSRD-ENC Rock Island, IL 61299-7390 (309) 782-5611, DSN 793-5611 FAX: (309) 782-7170 e-mail: joann.m.carmichael@us.army.mil	Mr. Steve Dundas DGIIP National Defence Headquarters 101 Colonel By Drive Ottawa, Ontario, Canada K1A 0K2 (613) 992-5398, DSN (319) 842-5398 FAX: (613) 995-0028 e-mail: Dundas.sw@forces.gc.ca

5. Exchange of Information. The information contained in this point paper and the attachments was obtained from public sources and can be distributed within both DoD and DND. If a formal working group is established, participating subject matter experts, may exchange information pertaining to relevant Border Surveillance technologies in accordance with the NATIB MOU.

A formal working group would ensure that any information provided in accordance with an approved TOR is used only by the participants and then only for the purpose for which it has been provided. Information will not be disclosed or released to any third party, including defense contractors, or used for any other purpose without the prior written consent of the providing participant.

6. Legal Status. Establishing a Working Group by having a signed TOR constitutes an administrative procedure to coordinate NATIBO activities between the Participants. It is not the intent of the Participants that this document be considered a legally binding document under international law. A TOR by itself does not create any authority to perform any work, award any contract, exchange information, transfer funds, or otherwise obligate in any way either Participant to make or provide any financial or non-financial contribution to the other Participant for any purpose. Any collaborative activities identified for investigation by the Working Group would be pursued in accordance with the terms and provisions of the NATIBO MOU.

7. Financial implications. This document or an approved TOR creates no financial commitments regarding individual PAs. Detailed descriptions of the financial provisions for a specific project, including the total cost of the project and each Participant's cost share, will be contained in the specific PA.

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IBIC appreciates any comments or suggestions regarding our products

IBIC Project 07-005

DATE: 11 May 07

PROJECT SUMMARY MEMORANDUM

SUBJECT(s):	**BORDER SURVEILLANCE ANALYSIS FOR NATIBO**
REQUEST DATE:	**15 Mar 07**
CUSTOMER(s):	**North American Technology & Industrial Base Organization (NATIBO)**

INFORMATION REQUESTED:
The customer requested an assessment that identifies technologies, systems and suppliers associated with potential border surveillance applications. To focus the effort, the scope is limited to the following environments:

- Airborne Sensor Systems, including; Unmanned Aerial Vehicles, Airships, and/or Aerostats, (RF, Electro-Optical, Infrared, Video)
- Land-based Sensor Systems (Attended/Mobile and Unattended: e.g., CCD, Motion, Acoustic)
- Maritime Sensor Systems (RF, Electro-Optical, Infrared)

Specific information requested for each area includes:

- Narrative descriptions, as appropriate
- A table of US & Canadian military systems already in use and from which manufacturer
- A table of US and Canadian military technology projects/concepts (lead organization/laboratory and/or contractor)
- A table of foreign companies providing systems or technology
- Products or technologies (US and Canadian) that may be relevant to the border surveillance mission.

FINDINGS/COMMENTS:

Findings

Extensive research revealed 32 companies and/or organizations for inclusion in this report. Section 1, the border surveillance summary section, identifies all companies and/or organizations their applicable environment(s) and indicates whether they are involved in developing technologies. Section 2 identifies 22 US and Canadian companies, a brief description of their border surveillance systems/products and the applicable environment(s) for each system/product and/or technology. Section 3 identifies US and Canadian technology projects/concepts by organization/laboratory/contractor. Section 4 identifies foreign companies and their surveillance systems/products and/or technology, and the applicable environment(s). Many of these companies/organizations produce systems/products and/or develop technologies for more than one environment (air, land, maritime). The environments are labeled and color coded; A for air is light blue, L for land is green, M for maritime is dark blue, and T for technology is brown.

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BORDER SURVEILLANCE SUMMARY

The Department of Homeland Security (DHS) is implementing several initiatives toward securing the border, including the Secure Border Initiative (SBI) and the Western Hemisphere Travel Initiative (WHTI).

SBI takes a systematic approach to border security by integrating and unifying border security systems, and developing and coordinating programs and policies to secure the border and efficiently enforce customs and immigration laws.

The goal of WHTI is to strengthen border security and facilitate entry into the United States for U.S. citizens and legitimate foreign visitors.

BORDER SURVEILLANCE PLATFORMS

Securing national borders has become increasingly difficult. Global deployments call for a wide range of mission capabilities requiring flexible, high-performance multi-sensor systems, installed and operated from a variety of platforms. The most effective intrusion detection systems use multiple technologies to increase the probability of early detection with low false alarm rates under a range of atmospheric and lighting conditions. Closed circuit television (CCTV), infrared image cameras, surveillance UAVs, long range radar and laser radar (LIDAR) are often deployed in appropriate combinations.

Short- and medium-range platforms integrate a wide variety of sensors - including such systems as taut-wire perimeter detection, vibration intrusion detection, electromagnetic intrusion detection, electrostatic field disturbance, electro-optical observation, and even microwave field disturbance detectors.

- Perimeter fences – deploy a variety of electronic surveillance technologies for intrusion detection and warning. These ground-based systems are primarily short-range, up to around 500 meters.
- Observation towers extend surveillance capabilities many tens of kilometers further from a border installation, and provide a platform for ground-based medium-range surveillance.
- Mobile surface observation platforms, such as land vehicles as well as maritime vessels, patrol frontier regions and coastal waters, extending the reach of medium-range surveillance sensors.
- Observation aerostats, stationary platforms, generally tethered balloons, allow for extended observation over wider areas, extending the reach of surveillance sensors beyond what can be seen from an observation tower.

Stabilizing the platform is a challenge. To obtain high resolution images the sensors need stabilizing, otherwise detail is lost.

BORDER SURVEILLANCE COMPANY ANALYSIS

Many companies produce systems/products and/or develop technologies for more than one environment (air, land, maritime).

Table 1A lists all US and Canadian companies (22), their applicable environment(s), and indicates whether they are involved in developing technologies. A US or Canadian company that has an X in any environment column (Air, Land, Maritime) indicates it has one or more systems/products in Section 2. A US or Canadian company/organization that has an X in the Technology column indicates it has one or more systems/products in Section 3. Table 1B lists all foreign companies (10) and their applicable environment(s). Section 4 contains detailed information regarding all foreign companies.

Table 1A. Summary of US and Canadian Companies

US & Canadian Companies	Applicable Environment(s)/Technology			
	Air	Land	Maritime	Technology
1. Alliant Techsystems (ATK) Integrated Systems	X			
2. Amitex Corporation				X
3. Array Systems Computing Inc. (privately owned Canadian company)			X	
4. Ball Aerospace & Technologies Corp. (Ball ATC) a subsidiary of Ball Corporation	X	X	X	
5. The Boeing Company Integrated Defense Systems (IDS is a Division of Boeing)				X
6. DeTect Inc.	X	X	X	
7. DRS Technologies	X	X	X	
8. ERA	X	X	X	
9. FLIR Systems	X	X	X	
10. General Atomics	X			
11. General Dynamics Canada (Canadian subsidiary of General Dynamics)			X	
12. Goodrich Corporation			X	
13. GSC Research				X
14. Harris Corporation		X		
15. ICx Technologies		X		
16. L-3 Wescam (Wescam is a Canadian subsidiary of L-3 Communications)	X			
17. Lockheed Martin	X		X	X
18. Naval Air Systems Command (NAVAIR)				X
19. Northrop Grumman	X			X
20. QuickSet International, Inc.			X	
21. Raytheon Company	X		X	X
22. Recon/Optical, Inc	X		X	X
23. Technest Holdings	X	X	X	
24. Telephonics Corporation	X	X	X	

Table 1B. Summary of Foreign Companies

Foreign Companies	Applicable Environment(s			
	Air	Land	Maritime	Technology
25. BAE Systems PLC (BAE Systems Inc. is a US subsidiary)	X		X	
26. Cedip Infrared Systems			X	
27. Chelton Microwave (US Subsidiary of Cobham PLC)			X	
28. Chess Dynamics		X	X	
29. Controp Precision Technologies (has a US Subsidiary)			X	
30. ELBIT				
31. ELTA Systems Ltd	X	X	X	
32. Kollsman				
33. Rheinmetall Defence Electronics				
34. Thales UK (A company of Thales Group)				

US & CANADIAN BORDER SURVEILLANCE SYSTEM/PRODUCT MANUFACTURERS

This section includes the following US and Canadian border surveillance companies:

- Alliant Techsystems (ATK)
- Array Systems Computing Inc.
- Ball Aerospace & Technologies Corp. (Ball ATC) a subsidiary of Ball Corporation
- DeTect Inc.
- DRS Technologies
- FLIR Systems
- General Atomics
- General Dynamics Canada (Canadian subsidiary of General Dynamics)
- Goodrich Corporation
- Harris Corporation
- ICx Technologies
- L-3 Wescam (Wescam is a Canadian subsidiary of L-3 Communications)
- Lockheed Martin
- Northrop Grumman
- QuickSet International, Inc.
- Raytheon Company
- Recon/Optical, Inc
- Technest Holdings
- Telephonics Corporation

Table 2 provides detailed US and Canadian border surveillance company data including: company name hyperlinked to its About Us/Profile page, a brief description of its systems/products, and the applicable environment(s) for each. The environments are labeled and color coded; A for air is light blue, L for land is green, M for maritime is dark blue, and T for technology is brown.

Table 2. US & Canadian Manufacturers: Surveillance Systems/Products/Technology

Environment (A,L,M,T)/System/Product Name
Alliant Techsystems (ATK)
ATK SMA is a division of Alliant Techsystems Inc. concentrating on integrating Intelligence, Surveillance and Reconnaissance (ISR) systems onto various aircraft for border, maritime and high value asset protection. ATK SMA has developed a proprietary “system of systems” approach using its STAR mission computer to fully integrate sensor data, displays, moving maps and communication and data links to provide line of sight and beyond line of sight information to ground and decision making agencies. More than 50 ISR systems have been delivered and are operational with Custom and Border Protection, Air National Guard, USAF, and DEA. A **Maritime Patrol Aircraft:** ATK SMA purchased new Bombardier Dash 8 aircraft, fully integrated an EO/IR sensor, sea surveillance radar, displays and recorders and delivered the completed aircraft ahead of schedule. Data recorders document mission results and have been used in judicial proceedings against drug traffickers and illegal aliens. This program has been recognized as a highly effective multi-role system and additional aircraft and systems are on contract. A **Other Systems:** Single engine and multi-engine turbo-prop aircraft have been modified to with specific systems to increase the capabilities to patrol borders and approaches to the US mainline. Some aircraft have only EO/IR sensors while others add air intercept radars. This combination of systems permits high degree of flexibility in assigning assets to particular threat areas or rapidly moving them to emerging requirements. For instance, aircraft designed for border and counter-drug protection were recently used during the California fires to locate hot spots through thick smoke and permit fire fighters to deploy to highest priority areas. Similarly, these systems were of

tremendous value during Katrina and other natural disaster relief.

USAF Systems: ATK SMA has developed a roll-on/roll-off ISR capability for C-130 and similar "ramp style" aircraft that enables a cargo aircraft to be quickly converted to perform ISR tasks. This system is combat-proven and available. In addition, ATK SMA has modified aircraft for US Special Operations Command and international customers.

Array Systems Computing Inc.

Canadian company is a world leader in the design, development and deployment of COTS-based sonar systems for post-mission analysis.

M Sonar Systems UAAS, SAPPS, GASS, CANTASS PAS

A L M TriSAR - a real-time, high resolution, SAR Processor. The system is designed to meet the needs of both land and maritime surveillance requirements. TriSAR developed as part of the Canadian program to modernize the Aurora Maritime Patrol Aircraft (MPA) and selected by the British Ministry of Defence (MoD) for modernizing the British NAF Nimrod. Array was subcontracted by Thales Sensors, of Crawley England, to provide the TriSAR capability for the Searchwater 2000MR radar.

Ball Aerospace & Technologies Corp.

A subsidiary of Ball Corporation. BALL ATC provides a variety of Tactical Electro-Optical Sensors.

A L M HISTAR (Hyperspectral Imaging for Surveillance and Targeting), a long wave infrared (LWIR) band Fourier Transform Spectrometer (FTS). HISTAR supports many different applications, from ground-based to airborne remote sensing and intelligence gathering missions. It is agile enough to be mounted on a variety of aircraft and can be moved quickly from platform to platform. The Office of Naval Research (ONR)/Naval Research Laboratory sponsored the initiative for this technology as part of the Future Naval Capabilities (FCN) process.

Table 2. US & Canadian Manufacturers: Surveillance Systems/Products/Technology (Continued)

Environment (A,L,M,T)/System/Product Name
DeTect Inc.
A L M MERLIN Sentinel - The MERLIN Sentinel radar provides full coverage of the surrounding area from ground level to altitudes up to 20,000 feet. It allows the system to function as a multi-purpose sensor for simultaneous detection and tracking of aircraft, vehicles and pedestrians and is an ideal solution for many force protection and homeland security applications. MERLIN Sentinel applications and areas include: • Ground perimeter security • Airspace monitoring & surveillance • Marine surveillance • Intrusion detection • Collision & obstruction avoidance • Commercial airports & military airfields • Industrial plants, refineries & power plants • Ports, waterways & coastlines • High security facilities
L Mobile Border Patrol Security Radar - DeTect has developed a small, portable security radar for border patrol and other similar ground security applications. The system is mounted onto the patrol vehicle with full display and control inside the truck cab, and provides continuous monitoring of the surrounding area out to 2 nm.
DRS Technologies
M AN/SQR-17A (V2000) Acoustic Surveillance System - bottom-mounted phased arrays, sonobuoys and other sensors detects and provides acoustic threat data using both fiber optic and RF links to shore, monitors surface ships, small boats, submarines, minisubs and swimmer delivery vehicles.
L M Coastal and Harbor Surveillance System - deployed in a fixed site or van for re-locatable installation, provides underwater acoustic surveillance of ships, small high-speed surface craft, submarines and swimmer delivery vehicles operating off shore. Passive acoustic sensors (or optional active acoustic and other sensor options) to detect intrusion into coastal and in-shore areas. When a threat is detected, information about the intruder is available immediately to national authorities via command, control and communications links.
L M Coastal Border Surveillance System (CBSS) - manufactured by MSSC (a joint venture of DRS Communications Company, LLC and THALES Naval Nederland), the CBSS is a fully integrated mobile surveillance system. It combines SCOUT, a virtually undetectable Frequency Modulated, Continuous Wave (FMCW) radar, with an electro-optical (EO) system for rapid target detection and identification/classification. The system is packaged in a mobile shelter on a High Mobility Multipurpose Wheeled Vehicle (HMMWV) or other vehicles and is powered by a diesel-fueled generator set on a trailer. Off-the-shelf components make the CBSS a cost-effective surveillance system with low life cycle costs.
L M Integrated Sensor Command System (ISCS) - robust command and control system. Designed to detect and identify surface, subsurface, swimmer, air, ground and human targets. Features automatic detection and tracking, operator alerts, continuous update of data, simultaneous target and incidents management. It is scalable to allow integration of additional sensors and systems and has an open architecture for easy expansion

Table 2. US & Canadian Manufacturers: Surveillance Systems/Products/Technology (Continued)

Environment (A,L,M,T)/System/Product Name
DRS Technologies (Continued)
M Lightweight Acoustic Sensor System (LASS) - bottom-mounted phased array detects and provides acoustic threat data to the AN/SQR-17A (V2000) Signal Processor System by monitoring surface ships, small boats, submarines, mini-subs and swimmer delivery vehicles. Transmits data to shore sites using either VHF radio links with a commandable surface buoy or to connect to shore via fiber optic cable. LASS is rapidly deployable for coastal surveillance and harbor protection.
A MMS (Mast Mounted Sight) - is a unique surveillance system consisting of a multisensor, fully integrated electro-optical sighting system that has visible and infrared day/night/inclement weather capability. MMS uses a combination of high-resolution television camera, thermal imaging sensors and a laser rangefinder/designator to accomplish its mission. The sensor suite is supplied by Northrop Grumman. MMS is one of the key elements of the OH-58D Kiowa Warrior. Mounted above the helicopter rotor, MMS provides natural stealth and extended standoff range by allowing the craft to hide behind existing terrain while maintaining 360-degree surveillance with the ability to acquire, identify, and derive the coordinate locations of potential target. An additional feature is the Airborne Target Handover System, which allows targeting information from one aircraft to be transmitted to another or to ground-based weapons.
L MSTAR (Manportable Surveillance and Target Acquisition Radar) a low-power ground surveillance radar that provides wide-area coverage in all weather conditions, night or day locating moving targets and classifying them as personnel, tracked or wheeled vehicles. Maximum range: 25 miles. Ideally suited for a deployable perimeter security application or as part of an integrated security system for force protection, border surveillance and asset protection. MSTAR is deployed in both fixed site strategic and transportable tactical applications.
M Radar Scan Converter Subsystem (RSCS) - based on proven COTS scan conversion technology, provides complete high-performance, dual-video display processing path for multiple radar images.
L **M** Reconnaissance, Surveillance & Target Acquisition (RSTA) - sensor housing • GS207 Stabilized Multi-Sensor 7" Gimbal • GS410 Stabilized Multi-Sensor Gimbal • GS414 Stabilized Multi-Sensor Gimbal
M SEA OWL Unmanned Surface Vessel - protects marine assets by patrolling shipping lanes and gathering vital data, above or below the surface, using day/night or thermal cameras, sonar, radar, environmental sensors and spotlights. A remote operator, in a secure location, effectively patrols miles of coastline or harbor gathering real-time images or data on both surface and sub-surface targets. The Sea OWL's patented, multi-channel lightweight hull features interchangeable components and a modular design enabling easy installation of sensor packages or technologies. Speed and stability make this the perfect craft for use in coastal and port security, anti-submarine efforts, counter-mine measures, and national resource defense situations.
L Squire Battlefield Surveillance Radar - Squire is a man-portable, battlefield surveillance system enabling the detection and classification of moving ground targets up to 48 km. Squire can be deployed in peacetime to safeguard valuable asset areas, including oil fields, power stations and other potential targets, from terrorist or criminal acts. The system is suited for assisting in counter-drug operations, control of border intrusion and force protection.

Table 2. US & Canadian Manufacturers: Surveillance Systems/Products/Technology (Continued)

Environment (A,L,M,T)/System/Product Name
DRS Technologies (Continued)
M Surface Electronics Acoustic Link (SEAL) - lightweight, self-contained, buoy transmits various types of acoustic sensor data to shore without the need for large deployment and recovery vessels. It connects to sub-surface sensors and arrays using a fiber optic link to support wide sensor bandwidth and simplifies at-sea interconnectivity. Easily deployed and retrieved by a small boat. M SWD100 Bottom Mounted Shallow Water DIFAR Sensor - This sensor is a modified version of the SSQ-53 sonobuoy sensor, with improved attributes for extreme shallow water conditions and extended periods of performance. The sensor has a 14-day battery pack and flotation collar, which connects to the bottom resting sensor unit. The sensor and surface electronics are easily deployed and retrieved by a small boat or may be deployed as an expendable package. L M DRS Technologies Canada a subsidiary of DRS Technologies Inc., and conducts business in Canada from four facilities. Core competencies of Ottawa facility include: designs, manufactures and supports a broad range of military communications, electro optics, surveillance, and sensor signal processing systems for naval and ground applications. **Note:** On 3 APR 07, DRS and the Thales Group announced that they have formed DRS Sonar Systems, LLC, a DRS majority-owned joint venture company with Thales North America, Inc. The company will focus on undersea warfare systems for defense and homeland security applications.
ERA
A L M Passive Surveillance - The passive technology utilized by Era allows for a virtually undetectable operation, as no signals are sent from the system. Vera by Era utilizes multilateration techniques to locate and track targets by triangulating on various electronic emissions in a broadband range, including emissions from transponders, radar, jammers and TACAN/DME interrogators. Due to its construction, Vera by Era is both mechanically and technically covert. Additionally, it is designed to be completely unobtrusive, allowing for camouflage in any surface environment.
FLIR Systems
A M BRITE Star - Developed from the SAFIRE/Star SAFIRE™ AN/AAQ-21/22 family, the BRITEStar combines a high-resolution 3-5 µm indium antimonide (InSb) Focal Plane Array (FPA) IR imager, a CCD TV camera and an eye safe laser designator/range finder. It is a cost-effective, military-qualified, multisensor laser designation system that incorporates an advanced third-generation thermal imager, a TV camera, a laser designator and a laser designator/rangefinder. Options include an autotracker, a target accumulator; laser spot tracker, digital video output and night vision goggle compatibility. The BRITEStar is used on the UH-1N. M Mariner - low-cost thermal imager mounted in rugged pan/tilt housing. Superior to night vision devices, it uses the same thermal imaging technology that the military uses. L MilCAM Recon - MilCAM Recon puts state-of-the-art infrared imaging in the palm of your hand for an unprecedented viewing capability at multi-kilometer distances. A MicroStar™ II The smallest and lightest stabilized IR gimbal on the market, designed for weight- and/or size-restricted airframes like UAVs. It applications include tactical surveillance, force protection and Search and Rescue (SAR) roles. It incorporates dual imaging sensors - high-resolution infra-red and boresighted CCD-TV with low-light capability. With its advanced autotracker and on-board targeting computer, the system is fully capable of supporting autonomous preplanned operations. UAV remote operations control functions are configured in FLIR's robust interface software dubbed Terse Binary Protocol (TBP) and designed to work with FLIR's Laptop Control Unit (LCU). The simple, intuitive, and non-fatiguing LCU was created to support operators during extended periods of system use. The MicroStar II is used on the RQ-7A Shadow UAV

Table 2. US & Canadian Manufacturers: Surveillance Systems/Products/Technology (Continued)

Environment (A,L,M,T)/System/Product Name
FLIR Systems (Continued)
M Navigator - features the same thermal imager found in many of FLIR's military products, designed for long life and ease of operation.
A L M Sea FLIRIII - lightweight multi-sensor thermal imaging system that operates from maritime, surface and airborne platforms, ideal for maritime and coastal imaging
A M Sea Star SAFIRE III - multi-sensor thermal imaging system designed for seamless maritime and airborne adaptability. Excellent range performance with 24-hour coverage, through a variety of obscurants and weather conditions. The system can be mounted upright, inverted or on its side to meet mission and platform requirements, and can be removed or installed in less than an hour.
A M Star SAFIRE HD – The first all digital, high-definition stabilized airborne thermal imaging system. It is fully configurable with up to seven payload options. It is a revolutionary product for imaging applications since it provides clear, highly detailed imagery that is critical in challenging littoral and urban environments. Applications include national security, intelligence, surveillance, reconnaissance, search and rescue, border patrol, coastal patrol, unmanned aerial vehicles, and navigation. The Star Safire HD is used on the Joint Land Attack Cruise Missile Defense Elevated Netted Sensor System (JLENS), an early warning and surveillance system installed on an aerostat. The JLENS sensor suite includes surveillance radar (SR) and a precision track and illumination radar (PTIR). The SR provides a long-range air picture enhanced by identification friend or foe. The PTIR is a steerable, lightweight array capable of tracking multiple targets in a sector. This system is recommended for Border Patrol applications by the manufacturer.
A Star SAFIRE II The world standard in COTS thermal imaging technology, Star SAFIRE II can carry up to five separate payloads: long-range thermal imager, low-light TV, ultra long-range spotter scope, laser rangefinder and laser illuminator. The system sets new standards for range performance, stability and image quality. Incorporating the latest InSb (Indium Antimonide) focal plane array technology, Star SAFIRE II enables users to adopt standoff distances 50% greater than before, thereby increasing mission safety and stealth. Its advanced 5-axis stabilization system provides precise motion correction in the fourth and fifth axes, enabling increased magnification to be utilized to increase detection and identification ranges. Star SAFIRE II's dynamic target autotracker follows maneuvering targets from moving aircraft, decreasing operator workload. The Star SAFIRE II is used on aircraft such as the H-60, UH-60 and Super King Air 200.
A Star SAFIRE III Star SAFIRE III's hermetically sealed, investment-cast turret features continuous 360-degree azimuth pointing, equipping camera operators to stay on target regardless of aircraft attitude. The super-narrow FOV delivers long-range target recognition with exceptional thermal image clarity. Multiple hand-controller configurations provide easy integration into operator stations, minimizing fatigue and improving mission effectiveness. It can be configured with a wide range of optional payloads, including a laser rangefinder, laser pointer, image-intensified CCD, low-light CCD TV, laser illuminator, and a three FOV color spotter scope. The Star SAFIRE III is the radar used for the rapidly elevated aerostat platform (REAP), 15M aerostat, and the Coast Guard SV-911 Eagle Eye Tiltrotor.
L TacFLIR II - The TacFLIR II is a compact, rugged, gyro stabilized multi-sensor thermal imaging system for use on a variety of land vehicles for long range reconnaissance, mine detection, or as a vehicle viewer. It provides up to 450 mm of continuous IR zoom with a matched daylight/lowlight TV.

Table 2. US & Canadian Manufacturers: Surveillance Systems/Products/Technology (Continued)

Environment (A,L,M,T)/System/Product Name
FLIR Systems (Continued)
L TacFLIR III - The TacFLIR III is a compact, rugged, gyro stabilized multi-sensor thermal imaging system with Geo Targeting capability. Designed for use on a variety of land vehicles for long range reconnaissance, mine detection, as a vehicle viewer, or as part of a weapon system the TacFLIR III provides up to 450 mm of continuous IR zoom, with a matched daylight/lowlight TV.
L ThermoVision 2000 - Platform mounted, exceptionally long-range, high-resolution infrared surveillance system.
M ThermoVision Integration Series - low cost surveillance camera system, which adds the power of thermal imaging to a CCTV Network.
M ThermoVision Nexus - architecture (Sensor Command and Control System) that allows multiple users to monitor and adjust myriad sensors throughout a security network.
L ThermoVision Ranger II - Rugged weatherproof digital system optimized for medium or long-range thermal imaging surveillance in mobile or field installations
M ThermoVision Security HD - a compact, multi-sensor thermal and visible-light imaging system with an integrated pan/tilt mechanism.
L ThermoVision Sentry - Military qualified, uncooled thermal imaging system featuring integrated pan/tilt with continuous 360º panning designed for wide area surveillance and 24 hour security.
M ThermoVision WideEye™ - World's first panoramic thermal imager with a 180º field-of-view. It is ideal for short-range applications, where a pan/tilt system might miss the action.
Camera Systems
A STAR Q - Incorporating the new QWIP (Quantum Well Infrared Photodetector) long-wave infrared focal plane array, the Star Q provides long-range imaging capabilities from altitudes and standoff ranges previously not possible. Star Q also delivers exceptional TV performance with a 3 CCD broadcast color camera. Recommended for Border Patrol applications by the manufacturer.
A Ultra Media III Aerial Camera Systems – This aerial camera system is totally digital and uses the industry-standard Ikegami HL-59 camera. Mated to the Ikegami camera is a 1000 mm Canon lens, enabling really close shots and standoff when air traffic control limits the air crew's access to the scene of newsworthy events. To make longer focal lengths possible, the Ultra Media III is equipped with advanced stabilization technology. The Ultra Media III is used on the Aeros airships.
A Ultra 7500 The triple payload capable Ultra 7500 is designed to meet the multi-role mission requirements of law enforcement organizations by increasing standoff ranges and improving surveillance capabilities. The continuous zoom infrared imager and 18x low-light TV camera can be combined with an optional Class III3b laser. Ground forces equipped with night vision goggles can clearly see the 30 mw laser's beam and spot, though it remains invisible to the suspect. On-screen graphics promote more rapid in-flight decision-making. Recommended for Border Patrol applications by the manufacturer.

Table 2. US & Canadian Manufacturers: Surveillance Systems/Products/Technology (Continued)

Environment (A,L,M,T)/System/Product Name
FLIR Systems (Continued)
A Ultra 8500 FLIR's lightweight, triple-payload capable Ultra 8500 is designed to meet the multi-role mission requirements of airborne law enforcement by offering increased stand-off capabilities, state-of-the-art infrared imaging performance and best-in-class autotracking for improved surveillance capabilities. The Ultra 8500 includes a high-definition, all-digital, InSb thermal imager, and a 18X-zoom low-light TV camera. The TV and IR telescopes can zoom independently or together, offering improved situational awareness. Add the optional laser pointer, and ground forces equipped with night-vision goggles can clearly see where the FLIR is pointing, greatly improving co-ordination between air and ground personnel without excessive radio chatter. Icon-based, on-screen color graphics and a simplified hand control unit promote rapid in-flight decision making. Recommended for Border Patrol applications by the manufacturer.
A Ultra 8500 XR FLIR's new lightweight, triple-payload capable Ultra 8500 XR is designed to meet multi-role mission requirements by offering increased stand-off capabilities with state-of-the-art thermal imaging performance and a long range daylight/lowlight CCD. The Ultra8500 XR's high sensitivity 320 x 240 InSb infrared imager has 450 mm of zoom, and the new lowlight TV camera offers matched performance. A Class III3b CW diode laser pointer can be added to improve ground coordination. Ground forces equipped with night-vision goggles can see the 30-mw laser's beam and spot, though it remains invisible to the suspect. Color on-screen graphics promote rapid in-flight decision making. Recommended for Border Patrol applications by the manufacturer.
A Ultra 8500FW The new, lightweight, triple-payload capable Ultra 8500FW is designed for fixed-wing surveillance applications, particularly on lightweight aircraft or airframes where reduced drag is important. The 8500FW offers extraordinary range performance for its size with a new optical extender delivering a 450-mm focal length. The system features FLIR's new high-definition digital infrared InSb imager, delivering image quality on par with systems at twice the cost. The 8500FW comes standard with a new laptop controller designed with a large, comfortable joystick for extended missions. FLIR's best-in-class auto-tracker, continuous IR zoom, .2 lux low-light TV and full auto-focus make this system the ideal choice for fixed-wing surveillance applications. With the optional Class III3b CW diode laser pointer, ground forces equipped with night-vision goggles can clearly see the 30-mw laser's beam and spot, though it remains invisible to the suspect. Icon-based, on-screen color graphics promote rapid in-flight decision-making. Recommended for Border Patrol applications.
A Ultra Force II UltraFORCE II-EP incorporates a four-axis stabilized composite turret that delivers exceptionally stable imagery. The system features a Gen-III long-wave QWIP infrared imager, and a 16x zoom, 3-CCD broadcast-quality color TV camera. This flexible day/night, long-range imaging capability allows surveillance at greater altitude and at longer standoff ranges than previously possible. Optional spotter scope, laser rangefinder and laser pointer payloads, as well as a host of ancillary devices, can be included to enhance the unit's mission performance. Recommended for Border Patrol applications by the manufacturer
General Atomics
A AN/APY-8 (Lynx) A multifunction Synthetic Aperture Radar (SAR) operating in SAR and Ground Moving Target Indication (GMTI) modes. The echoes of the radar signals are processed by the system into high-resolution images, and delivered via data link to the Ground Exploitation Station. LYNX consists of a radar electronics module and antenna mounted on a gimbal assembly weighing a total of 52kg. It provides photographic quality ground pictures at resolutions ranging from 0.1 to 3 meters. The radar can also scan a large or small area for moving objects, detecting targets at speeds typical of vehicular movements (10 – 70 kph). When transferred to the ground station, moving target data is usually overlaid on a digital map to generate situational awareness map. AN/APY-8 Lynx II is a lightweight version of Lynx operating on the US Air Force Predator RQ-1 UAV. A new version designed for operation at extended range and high altitude is Lynx ER, currently fielded with US Air force Predator B MQ-9. Lynx II is planned for fielding with the US Army on several platforms, including FireScout (FCS Class IV), ER/MP and Hunter.

Table 2. US & Canadian Manufacturers: Surveillance Systems/Products/Technology (Continued)

Environment (A,L,M,T)/System/Product Name
General Dynamics Canada
A Subsidiary of General Dynamics (GD), GD Canada is uniquely positioned as a comprehensive battlespace integrator with operationally tested systems experience on advanced platforms and proven C4ISR integration capabilities. **Note:** The following are considered to be relevant to the border surveillance mission L M MOATS (Multi-mission Open Architecture Tactical System) is designed to integrate off-the-shelf sensors; the system provides a flexible vehicle for integration of a modern mission system. This allows GD Canada to select best in class sensors and subsystems to meet a wide range of operational needs. In addition, the MOATS architecture is designed to accommodate different crew sizes from small, helicopter platforms, to large fixed wing patrol aircraft, with a user interface designed in conjunction with experienced operators. M Sonobuoy Processing GD Canada has delivered state-of-the-art systems that process as few as 4 sonobuoys to larger systems that process 64 sonobuoys concurrently, and designed systems to be controlled through a dedicated stand-alone keyboard, a Data Management System (DMS) keyboard, or control through an X-windows environment. M FTAS – (Fast Time Analysis System) allows for fast-time and real-time Post Flight Analysis (PFA) of recorded sonobuoy information from all ASW platforms.
Goodrich Corporation
A M Laser Obstacle Awareness System (LOAS) provides users with detection of energized and non-energized wires, water-borne surface objects, airborne vehicles and threats. The multi-function scan head and electronics module are adaptable to numerous platforms. The information they provide can be easily integrated into control, targeting, and display systems. A M Laser Perimeter Awareness System (LPAS) a unique derivative of LOAS technology. LPAS provides comprehensive 360° surface threat awareness for military and civilian ships, at anchor or pier side, when radar and other ship systems are not active. **Note:** The following are considered to be relevant to the border surveillance mission T Advanced Sensors Technical Center (ASTC) one of two Goodrich Corporation technical centers providing advanced research and development support for all businesses in the company. ASTC develops the newest, most progressive sensing technology by applying expertise in the areas of optoelectronics, ultrasonics, laser technology, fiber optics and solid state micro-sensor development and fabrication. T SUI (Formerly Sensors Unlimited), now part of Goodrich, is a pioneer in the design and production of high speed PIN and Avalanche Photodiodes, and Indium Gallium Arsenide (InGaAs) detector technology. This technology provides near-infrared and shortwave infrared (SWIR) imaging for superior performance in extremely low light conditions. SUI has full in-house manufacturing capabilities for advanced cameras for a wide range of applications and markets: military; security; industrial; commercial and telecommunications. SUI products include imaging cameras, linear arrays, single element detectors, high-speed detectors and high-speed avalanche photodiodes (APDs). Applications include covert surveillance, missile tracking, industrial process monitoring, laser beam profiling, scientific instrumentation and telecommunications.
Harris Corporation
L Falcon Watch unattended ground sensors are a force-multiplier solution with a network of easily deployed remotely located products that detect the movement of personnel and vehicles. Sensors include: • RF-5400 Remote Intrusion Detection and Surveillance System • RF-5405VH-GW Intelligent Gateway • RF-5410 Sensor Management Application

Table 2. US & Canadian Manufacturers: Surveillance Systems/Products/Technology (Continued)

Environment (A,L,M,T)/System/Product Name
ICx Technologies
L Cerberus - Cerberus provides a fully customizable, mobile sensor tower suitable for rapid deployment wherever unmanned surveillance or communication is required.
L DefendIR - The DefendIR is an industry leading thermal imager combining both CCD and infrared technologies.
L Illuminator - Low-Light CCD Camera / High-Powered Spotlight.
L MarkIR - The markIR Tuned Band Emitters utilize a two-dimensional photonic crystal structure to tune and restrict he IR emission for visibility in only the desired spectral region.
L Orion - The Orion is a cooled IP addressable camera and is designed with test and diagnostic software to ensure ease of predictive/preventable maintenance and performance.
L Sky Watch - Sky Watch units provide a high level platform for an array of surveillance options. Every tower includes the basics for the comfort and safety of the officer inside through adjustable heat and air conditioning, tinted sliding glass windows, comfortable seating, a fold away table and basic first aid kit
L STS-350 - The STS-350 is a portable, low cost system consisting of one or more remotely stationed radar sensors networked to a central control and display unit.
L STS-1400 - The STS-1400 is a high resolution radar that accurately detects personnel and vehicles up to 1400 meters range. And, it operates in virtually any climate, weather or lighting condition to provide 24/7 security, scanning 360° every second.
L STS-12000 - The STS-12000 system is engineered to be an integrated radar and optical verification system. The radar system is a low power RF surveillance system (RDTS), while the optical system can be selected based upon user application.
L VisionIR - The VisionIR is a fixed thermal camera designed for perimeter security and surveillance and is an ideal solution for a multitude of security challenges.
L-3 Wescam
WESCAM is a Canadian subsidiary of L3 Communications
A M AN/APS-504 - A series of airborne search radars designed primarily for maritime patrol applications that are installed in either fixed- or rotary-wing aircraft. Formerly made by Northrop Grumman Canada, which is now part of L-3 WESCAM, Burlington, Ontario, Canada. The APS-504 Radar provides the capability to detect small targets, to conduct Search and Rescue Patrols, Maritime surveillance, Ice Patrols, Anti-Submarine Watch, Weather Detection, and Beacon Interrogation. Originally designed for antisubmarine warfare applications, it represented the next generation in digital X-band airborne search radar around the World in 1986. The AN/APS-504(V)5 Radar is an X-Band System with digital signal processing and scan conversion, which can provide radar video up to 200 NMI in range and 360 degrees in azimuth. Although these radars are in the process of being retired and replaced with more modern multimode airborne radars, they are a tribute to Canada's aerospace capabilities.

Table 2. US & Canadian Manufacturers: Surveillance Systems/Products/Technology (Continued)

Environment (A,L,M,T)/System/Product Name
L-3 Wescam (Continued)
A 12DS/TS200 Designed to meet the needs of law enforcement, paramilitary and surveillance applications, including Homeland Security and border patrol applications, the 12DS/TS200 provides high-performance detection, recognition, identification and tracking of targets in daylight, total darkness and in less-than-ideal weather conditions. Specific features include: • 4-axis gyro-stabilization • Seamless integration with WESCAM microwave downlink equipment • Color Daylight CCD camera, 3 FOV Thermal Imager, IR Illuminator (Tri Sensor) Plug & Play SmartLink interface - provides all the interfaces and options needed to control a stabilized airborne camera and associated peripheral equipment, making it compatible with microwave downlink equipment, searchlights, AutoTrackers, moving maps, GPS, radar and intercom systems. Designed for rotary and fixed wing platforms, the system is in use on aircraft such as the Bell 206 and Bell 412 and the Eurocopter AS-355. Weighing only 46 lbs, the systems are extensively deployed in law enforcement applications in the US, Mexico, New Zealand, and Japan.
A MX-15 (AN/AAQ-35) The MX-15 and MX-15i (integrated Master Control Unit variant) combine advanced gyro-stabilization and high-quality long-range optics in a multispectral sensor suite. The systems embrace a variety of applications, depending on sensor configuration. The payload consists of up to 6 optional sensors, including IR imaging, laser illuminator, Laser Range Finder/Designator (LRF/D). It provides multiwaveband coverage with day/night CCD with laser illuminator. It contains a high magnification MWIR (3 to 5 µm) IR TI with 4-step zoom, a color 1-CCD daylight camera with zoom lens, a color 3-CCD daylight camera with spotter lens, a monochromatic charge multiplying, CCD night camera with spotter lens, a diode-pumped laser illuminator, and eye-safe laser LRF. The CMCCD Night Spotter Camera's advanced features include Long-range subject ID (ship names, vehicles, faces, license plates) in very low-light conditions, improved visibility through haze, fog and other environmental obstacles, The MX-15 True HD variant includes state of the art 1080p High Definition imaging resolution (1920x1080). The systems are designed to be used on rotary and fixed wing platforms, Aerostats and UAV's. One current application is on the US Coast Guard HU-25 aircraft.
A MX-20 (AN/ASX-4) The MX-20 was developed specifically for long-range/stand-off surveillance and identification applications, combining highly accurate gyrostabilization with multiple, high-magnification, day and night vision sensors. The MX-20 turret supports up to six high-performance sensors. It comprises a 20 in sensor turret, operator and master control units, a joystick controller, a MIL-STD-704A power conditioning unit and interfaces for up to two image recorders and three display monitors. It also features a 5-axis gyrostabilization and 6-axis vibration isolation system which achieves an extremely low line-of-sight jitter in both fixed- and rotary-wing aircraft. The Mid-Wave IR (MWIR) Thermal Imager (TI) incorporates both large (640 × 512) and small (320 × 240) formats, together with a 4-step zoom capability. Multiple focal lengths, combined with an elite 1.5× optical extender, and fast step switching between focal lengths enable operators to rapidly detect, acquire and identify Pints Of Interest (POI) and maintain tracking, all at long stand-off ranges. A high performance EO sensor compliments the optics, with two different camera/lens options for advanced target recognition/identification purposes. The MX-20 was selected for the New Zealand Air Force's P-3K maritime patrol aircraft.

Table 2. US & Canadian Manufacturers: Surveillance Systems/Products/Technology (Continued)

Environment (A,L,M,T)/System/Product Name
Lockheed Martin
M Intruder Detection System (IDS) - The IDS is capable of automatically detecting, classifying and tracking swimmers of all types including the stealthy combat diver at long range regardless of the operating environment. The IDS is easy to use, and can be integrated with surface surveillance equipment such as marine radars, closed circuit and low light TV cameras, and infrared cameras.
A L-88 Series Radar– The L-88 solid-state coherent L-band (1.215 to 1.40 GHz) radar can detect both air and surface targets simultaneously, and can detect even small aircraft at ranges of up to 173 n miles (320 km; 199 miles). Based on the earlier AN/FPS-117, AN/TPS-59 and AN/DPS-5 radars, the L-88A exhibits proven concepts such as pulse compression, MTI filtering and coherent transmission, combined with the advantages afforded by recent improvements in integrated circuit technology. In addition to its airborne applications, the L-88 can be modified to meet the requirements of ground-based 2D gap fillers and long-range 2D search radars. The 317 kg (700 lb) lighter L-88(V)3 has the same characteristics but has only eight antenna rows instead of 16 and draws less primary power than the L-88A. Lockheed Martin is providing L-88(V)3 radar systems along the southern border of the US as part of the Tethered Aerostat Radar System (TARS), along with the 420K aerostat, which was designed specifically to carry the L-88 radar.
A M LLLTV The Low-Light-Level Television system is a general purpose multirole system. It was designed for maritime surveillance missions, but has potential for search and rescue and border patrol missions. Principal features are high resolution and sensitivity at low-light levels and a small (16 mm diagonal) format. It is claimed to be capable of resolution densities in excess of 30 lines/mm and to have a wide dynamic range, which provides useful imagery around brightly lit parts of the area surveyed. The camera head can be mounted in any attitude and is designed for hands-off operation. The most recent military application was a 1999 four year contract for Lockheed Martin to supply LLLTV systems for the AC-130 Spectre gunship to covertly illuminate targets during night operations for the aircraft's battery of 20-, 40- and 105-mm guns. Using the system, crewmembers can shine a laser "flashlight" on potential ground targets -- a beam that is invisible to the naked eye, but not to the image intensifying cameras which display the target as a TV image used for fire control. This system would allow border patrol crews to establish visual contact with surface targets during night and bad weather operations if mounted on an appropriate aircraft suitable for border patrol needs.
M Sea TALON™ - (Tactical Acoustic Littoral Ocean Network) a state-of-the-art undersea detection and surveillance system strategy that will detect, classify and track surface and subsurface threats. Designed using commercial-off-the-shelf (COTS) hardware and software, Sea TALON ™ provides continuous sensor information to shipboard or airborne command centers.
Northrop Grumman
L M Marine & Land-Based Sensor Arrays - Depending on the application, these arrays may contain optical geophones, fiber optic hydrophones, and/or fiber optic microphones. They may be deployed in all types of terrain and marine environments to accommodate such applications as perimeter security, harbor monitoring, and ground surveillance to name a few.
A Raven Eye I Northrop Grumman Defensive Systems Division and Israel Aircraft Industries' TAMAM Division (TAMAM) teamed to combine their expertise in the design and production of electro-optical (EO) payloads for intelligence, surveillance, targeting and reconnaissance for specified business opportunities. RAVEN EYE I is a day and night observation system with high quality thermal imager and color TV. The payload is a gyro-stabilized, dual sensor, single line replaceable unit (LRU) payload. It is modular, lightweight, and compact and has an attractive price performance ratio. Installed on unmanned platforms, the system is operated via datalink from a remote ground station. For manned platforms (helicopters, vessels, vehicles) an onboard single observer, using a specifically designed hand control grip and video monitor operates the system. RAVEN EYE I is based on a unique plug-in sensors module concept that can be easily replaced in the field within minutes.

Table 2. US & Canadian Manufacturers: Surveillance Systems/Products/Technology (Continued)

Environment (A,L,M,T)/System/Product Name
Northrop Grumman (Continued)
A Raven Eye II Northrop Grumman is again teamed with TAMAM for the RAVEN EYE II, a family of advanced, off-the-shelf EO payloads designed for day and night operation including surveillance and targeting functions. It is based on the design of the TAMAM Multi-Mission Optronics Payload (MOSP). Over 400 MOSP systems have been supplied for different types of fixed- and rotary-wing platforms. The Unmanned MOSP is specifically configured for integration on the Vertical Takeoff Unmanned Aerial Vehicle (VTUAV). RAVEN EYE II is supplied in triple sensor configurations that provide day and night observation, and laser rangefinding. Sensor configurations may be customer-tailored to meet specific requirements such as multiple day channels, fixed and variable zoom cameras, or a high quality color camera to provide broadcast image quality. RAVEN EYE II's small dimensions and excellent line of sight stabilization allow installation and use by virtually all helicopters, as well as other platforms that may require a high performance payload that is relatively small/light. L Unattended Ground Sensor (UGS) - The UGS is a covert, cost-effective acoustic / seismic battlefield monitoring device which can be air dropped or hand deployed. The system provides improved battlefield situational awareness - awareness that enables battlefield commanders to make the best decisions. The UGS contains a 12-inch microphone array, seismometer, electronic compass, GPS receiver, and a digital processor. UGS has demonstrated detection and classification of ground and air vehicles at tactically significant ranges
QuickSet International, Inc.
M GeminEye - Pan/tilt unit and controller designed to be less expensive and handle lighter loads (10 pounds or less) than the current models, currently used by NASA, the US Military and Border patrol for homeland security related surveillance. M Pan-Tilt Positioners - Features smart positioning controls, web-enabled remote operation, durability, sensor fusion and robust stabilization for a variety of payloads. M Marine models (QPT 20IC Marine and QPT 90IC Marine) use a corrosion resistance gasket material that provides a water tight seal to protect accessory wires & cables. M SeaView™ - Based on Sentry 90 marine pan/tilt unit with dual long range-imagers in both Thermal and CCD spectrums. SeaView is optimized for day/night, all weather conditions, an ideal system for long-range surveillance in coastal, harbor, and border environments. M Systems Controls - Full line of pan and tilt controllers can y be desktop or rack mounted. L M Ultra-Stable Tripods -- feature foot-operated brake locks, compact folding for easy storage, quick release and adjustable leg locks, built-in carrying handles for easy transport and can handle up to 400-lb payloads.
Raytheon Company
A AN/AAQ-26 The AAQ-26 infrared detecting set is a high-performance multipurpose thermal imaging sensor that provides long-range navigation, surveillance, and fire control capabilities. Employing off-the-shelf avionics, the units feature a second-generation focal plane array, electronic image stabilization, local area processing, and an adaptable interface. Additional features include a dual mode video tracker, a 1553 data bus or discrete controls, and multiple fields of view. The system is deployed on the AC-130H and the AC-130U gunships, but is designed to support a wide variety of platforms and missions. This FLIR Detection Set has replaced the AN/AAQ-17, also manufactured by Raytheon and previously used on the AC-130 aircraft, while the AN/AAQ-17's used on the MC-130 aircraft are being replaced by L-3 WESCAM's MX-15 in a contract with MTC Technologies.

Table 2. US & Canadian Manufacturers: Surveillance Systems/Products/Technology (Continued)

Environment (A,L,M,T)/System/Product Name
Raytheon Company (Continued)
A AN/AAQ-27 The AAQ-27 is a third-generation, mid-wavelength infrared (MWIR) imaging system that is in production for the V-22 Osprey. It allows pilots to see through darkness, smoke, haze, and adverse weather. The system incorporates a state-of-the-art MWIR InSb focal plane array with 480 x 640 detector elements. It has demonstrated superb image quality and range performance using non-developmental, in-production components to provide higher resolution imagery than current long-wavelength infrared systems. In addition, the staring sensor eliminates the moving parts needed for scanning infrared sensors, providing higher reliability that is estimated to be about 50% greater than that of earlier generation systems. The total system weighs less than 90 pounds, including about 50 pounds for the turret. An AAQ-27 retrofit kit allows the upgrade of fielded first-generation long-wavelength AAQ-16B systems. The AAQ-27 (3 FOV) version is in production for the Royal Australian Navy's Super Seasprite and Seahawk helicopters. A ARL-M The Airborne Reconnaissance Low-Multifunction (ARL-M) radar provides high-resolution Synthetic Aperture Radar (SAR) images in all weather, day or night. It is a multi-mode X-band SAR reconnaissance and surveillance system that in its SAR spot mode provides 1.8 meter resolution imagery of a 10-square-kilometer area. With its high-quality imagery and moving target indication capabilities, the ARL-M can be used for border surveillance, ground force movement, littoral region activities, land mapping, and resource management. The ARL-M, a derivative of Raytheon's HISAR™ system, is operational on the U.S. Army's RC-7B aircraft, made by DeHavilland Canada A AN/AAS-44(V) A high-performance infrared imager that offers multiple fields of view with real-time image processing and contrast enhancement. The AAS-44(V) Infrared Laser Detecting-Ranging-Tracking Set is a high-performance multipurpose thermal imaging sensor. While it also provides long-range surveillance, target acquisition, tracking, rangefinding, and laser designation for HELLFIRE and tri-service/NATO laser guided munitions, the system is also deployed on US Navy SH-60B and HH-60H helicopters and supports a variety of rotary and fixed wing platforms. A L M HISAR An adaptable airborne surveillance system that incorporates multiple sensors, air and ground workstations, and data links to fit a variety of mission needs. The system's Multimission Radar (MMR) performs real-time processing, and operates in all weather, night or day, making it the perfect choice for a diverse range of applications in surveillance and reconnaissance, environmental monitoring, and maritime surveillance. The high-resolution synthetic aperture MMR also features ground moving target indication, wide area coverage, long range, a sea surveillance mode, and detailed narrow sector search abilities. The multisensor options include forward-looking infrared (FLIR) sensors, as well as medium- and long-range optical sensors. This multiplatform turnkey solution is lightweight and adaptable, designed for installation on a variety of fixed-wing aircraft, including unmanned aerial vehicles. The HISAR radar is small enough to fit on an executive turboprop or jet. It is integrated on a number of platforms, including the King Air 200 and Beech 1900D, the de-Havilland-7 and -8, and the Grob Egrett (a German/US high-altitude long endurance manned single turboprop aircraft made out of composites, with a wingspan similar to a Boeing 737). HISAR™ 2K adds tethered aerostat compatibility. HISAR is Raytheon's turnkey offering to the airborne surveillance and reconnaissance market in the $10m to $30m-per-system class. A HISAR system in this class includes the airborne platform, sensors, ground station and a complete logistics package. Designed to perform a variety of missions, HISAR can be used for border surveillance, maritime patrol, environmental monitoring, detection of oil spills and other disasters. It also can be a valuable aid in curbing the drug trade, gun smuggling and other illegal activities. With its real-time, all-weather, day or night surveillance capabilities, the system is readily adaptable to a host of current and evolving needs.

Table 2. US & Canadian Manufacturers: Surveillance Systems/Products/Technology (Continued)

Environment (A,L,M,T)/System/Product Name
Raytheon Company (Continued)
A L M Integrated Maritime Surveillance (IMS) System - developed in collaboration with the Canadian government. Surveillance is accomplished by combining four key technologies: a) Long-Range HF Surface-Wave Radar (HFSWR); b) Automatic Dependent Surveillance (ADS) Systems; c) Other sensor systems; and d) Multiple-Sensor Data Fusion and displays.
A L M SeaVue™ a high-performance maritime and overland radar system that provides surveillance for fixed-wing, helicopter, ship and land-based applications. **Note:** On 03 April 2007 BAE Systems and Raytheon Company announced they formed a team to pursue opportunities under the Distributed Common Ground System-Navy (DCGS-N) program. The DCGS-N Enterprise Team will design and demonstrate a Web-based intelligence, surveillance, and reconnaissance (ISR) and targeting capability to support naval operations and other U.S. government agencies, military services, and US allies for a wide range of missions. The team also will research and offer suggestions on how best to transition these functions into the baseline DCGS-N program.
Recon/Optical, Inc
A M CA-295 Dual-Band High Altitude Camera performs a range of high-altitude, long-range missions while operating at standoff ranges beyond 50 nautical miles (nmi).
A M CA-270 Dual-Band Low to Medium Altitude Camera performs a range of low to medium-altitude missions. The CA-270 digital camera simultaneously produces both infrared and visible spectrum images, providing the user with day/night, near real-time data for ISR.
Technest Holdings
A L M Cerberus System - A reconfigurable multi-sensor system that is designed for long distance infrared and visible detection. Recent trends in mounted cameras for manned and unmanned vehicles have created the need for a distributable multi-sensor capability. The Cerberus delivers this flexibility while still maintaining seamless panoramic coverage up to 360-degrees. The unique architecture of the Cerberus also allows it to be stackable, for multiple layers of sensors with differing specifications. Combine infrared, near infrared, image intensified, MWIR, SWIR, and visible sensors to achieve unparalleled fused vision and motion detection with improved night vision in 360-degrees. The Cerberus system is designed for rugged field and maritime operations, with full salt water resistant and pressure resistant enclosures. Now land vehicles, naval surface ships, and permanent ground and sea installations have a new weapon to provide intrusion detection, enemy combat recognition, and surveillance. Applications include: Asset Protection, Border Control, Naval Protection, Port Security, Perimeter Control, and Surveillance
L OmniEye - The OmniEye 360-degree family of surveillance systems represents one of the video surveillance market's leading and most flexible wide-area sensor capabilities. Numerous configurations are available to meet diverse needs for commercial, government, and military customers.
L Small Tactical Ubiquitous Detection Sensors - (STUDS) - Disposable, miniature sensors that can be deployed (dropped) anywhere. They can be quickly deployed to form an adhoc perimeter surveillance system for wide area coverage. STUDS can alert personnel of movement by a person or car and send an alarm wirelessly from sensor to sensor to send the message to cue other sensors. Imagery can also be sent via wireless communications to confirm the threat potential. These small, inexpensive battery operated units that can fit into a pocket or pouch and dropped literally anywhere to provide a cost effective means of wide area surveillance where no one would expect it. Applications include: Asset Protection, Border Control, Networked Perimeter Control, Ad Hoc Perimeter Control, and Surveillance

Table 2. US & Canadian Manufacturers: Surveillance Systems/Products/Technology (Continued)

Environment (A,L,M,T)/System/Product Name
Technest Holdings
L Smart Optical Sensor (SOS) - Genex introduces a new generation of high-speed processing that is so small, it can fit inside your sensor. The Smart Optical Sensor (SOS) brings a whole new dimension in intelligent surveillance. The SOS enables remote surveillance by bringing USB 2.0, Ethernet, or wireless interfaces to any sensor.
L T Wide Area Surveillance System – (WASS) – A multi-sensor targeting system with real-time imaging, situational awareness displays and a 360-degree gimbal scan. Still in development, this product shows excellent potential for solving force protection, site monitoring and border-security problems. Applications include: Asset Protection, Border Control, Mobile Perimeter Control, and Surveillance.
Telephonics Corporation
Telephonics, a subsidiary of the Griffon Corporation, has three operating units, each with a different product/technology focus. Telephonics' RADAR SYSTEMS specializes in maritime surveillance radar and identification friend or foe interrogators
L ARSS-Advanced Radar Surveillance System - The ARSS ensures that critical intelligence is gathered in even the most intensified environments in all weather, both day and night. This lightweight, low power, coherent, ground-based system is rugged, reliable and mission customizable. The ARSS is ideal for establishing portable, fixed or highly mobile surveillance operations in the most demanding security, military and paramilitary applications.
A M AN/APS-143 Also known as OceanEye, the APS-143 is a maritime surveillance and tracking radar designed for installation in a variety of fixed-wing aircraft and helicopters. In addition to anti-surface and anti-submarine warfare missions, its sensor capabilities include search and rescue, coastal surveillance, contraband control and border surveillance. The latest variant, APS-143B(V)3, can be upgraded with a complete imaging capability: range profiling, ISAR, spotlight SAR, and strip-map SAR. The system can also incorporate a Tactical Data Management System (TDMS) for external systems such as FLIR, ESM, IFF and TDL. The OceanEye's multi-mode capability provides mission diversity making it a cost-effective sensor on any platform. This radar can be found in the Bombardier E-9A, the Canadian Air Force's CP-140 Aurora, the S-2E, HU-25, SH-60 Seahawk, SH-2G (Australia, New Zealand), and in aerostats.
M AN/APS-147 The AN/APS-147 multimode radar is an Inverse Synthetic Aperture Radar (ISAR) using high-throughput signal and data processing. Optimized for the maritime surveillance mission, the radar uses a variety of waveforms to perform its mission at a relatively low output power. Radar modes include target imaging, small target and periscope detection, long-range surveillance, weather detection and avoidance, all-weather navigation, short-range search and rescue, enhanced LPI (Low Probability of Intercept) search and target designation. Its flexible modular design can be tailored to meet specific requirements and can be easily upgraded. Highlights include high-resolution images for rapid classification, lightweight construction through the use of composite materials, low-input power, simple design for high reliability and maintainability, fully programmable signal processor with multiple waveform exciter and high-throughput rates and integrated IFF and SAR option. The AN/APS-147 is used in the MH-60R.
A RDR-1700 The RDR-1700 Search, Surveillance and Weather Avoidance Radar System is a lightweight, X-band, 360-degree (belly-mount) or 120-degree scanning (nosemount) digital color radar system. The three Line Replaceable Units (LRUs) include: antenna/pedestal unit, the receiver-transmitter unit and the interface unit. Control is provided via glass cockpit Multifunction Displays (MFDs) using an ARINC 429 interface. Waveguide pressurization is not required. A 20-target Track-While-Scan (TWS) capability is integral to this system. All radar controls are handled via a joystick, cockpit display, and bezel mounted key switches.

Table 2. US & Canadian Manufacturers: Surveillance Systems/Products/Technology (Continued)

Environment (A,L,M,T)/System/Product Name
Telephonics Corporation (Continued)
M RDR-1700B The RDR-1700B Maritime Surveillance Radar is an evolutionary development of the widely deployed RDR-1500B, infused with new capabilities from the RDR-1700 and APS-143B(V)3 systems. The RDR-1700B is a 1 kW X-Band, airborne, coherent, search radar providing manned or unmanned, fixed or rotary wing aircraft with the ability to search for, detect, and track targets while performing over water surveillance. Flexibility through programmability enables the RDR-1700B to be tailored and optimized to a wide variety of maritime surveillance missions including Airborne Maritime Patrol, Search and Rescue, Contraband/Illegal Immigration Control, Weather Avoidance, Coastal Surveillance, and Fisheries Protection. The system is planned for installation on the US Coast Guard HV-911 Eagle Eye VTOL Unmanned Aerial Vehicle (VUAV). **L** TACTICS - Telephonics offers a real time integrated approach to executing a Homeland Security strategy for public buildings, infrastructures, transit hubs and outdoor areas. The Telephonics' TACTICS System combines event monitoring through multiple sensors with rapid evaluation to trigger mass notification "alerts". The system is modular such that a wide range of sensor systems may be employed from intelligent video to CBRN monitoring. A publish-subscribe based decision-support system then issues the appropriate notifications through multiple mediums including public address, virtual messaging signs, wireless devices (PDA, Cell Phone, Pagers) and/or desktop computers.

US & CANADIAN BORDER SURVEILLANCE TECHNOLOGY PROJECTS/CONCEPTS BY LEAD ORGANIZATION/LABORATORY/CONTRACTOR

This section identifies US and Canadian border surveillance technology projects/concepts by lead organization, laboratory and or contractor, and a brief description of their technology projects/concepts. The environments are labeled and color coded; A for air is light blue, L for land is green, M for maritime is dark blue, and T for technology is brown.

Table 3. Future Border Surveillance Technology

Border Surveillance Technologies
Amitex Corporation
A T Homeland Security Innovation and Entrepreneurship Center (HSIEC) - In mid 2006, a Grant was awarded by HSIEC to help Amitex pursue critical business milestones. Amitex is working with the US military to develop technology that doubles the transmission range for UAVs by sending streaming video data to ground stations with less power consumption and at lower cost than current methods. This technology also has applications in homeland security such as border patrol where large coverage areas will benefit from aerial surveillance.
The Boeing Company Integrated Defense Systems
L T Secure Border Initiative (SBI) (System not the sensor) - The Secure Border Initiative is a comprehensive plan by the US Department of Homeland Security (DHS) to gain operational control of the US borders through the integration of increased staffing, interior enforcement, detection technology and infrastructure, and coordination on federal, state, local and international levels. A critical component of SBI is SBInet, a program focused on transforming border control through technology and infrastructure. SBInet will provide frontline personnel advantages in securing the nation's land borders through the most effective integration of current and next generation technology, infrastructure, staffing and response platforms. The Boeing led team includes Centech Group (Training), DRS Technologies, Kollsman Inc. (a subsidiary of Elbit Systems), L-3 Communications, LGS, Perot Systems, Unisys Global Public Sector, and USIS.
DRDC Valcartier
A L M T Airborne Infrared Imaging Spectroscopy (AIRIS) – AIRIS is DRDC Valcartier's new state of the art airborne hyper spectral imaging sensor developed under the Infrared Hyper Spectral Imagery (HSI) for Improved Aerospace Intelligence, Surveillance and Reconnaissance, technology demonstrator program. The sensor system is an extended waveband hyperspectral imager (Near IR, Mid IR and Long Wave IR) covering 2-12 microns. AIRIS has been developed using a modular approach to increase system flexibility, usefulness and allow for possible future sensor considerations. The system incorporates two distinct modes of operations using either a wide field of view (FOV) or a narrow FOV telescope. AIRIS is a NADIR system and provides target acquisition and tracking capabilities using geo-referenced, manual or pre-selected target area coverage. To facilitate target tracking, the total field of view of the spectral imager can be moved within a grid eight times larger. The sensor package includes hardware capabilities to support data acquisition for up to four hours. AIRIS has operated from the National Research Council Canada Convair 580 aircraft, but can be adapted to other airframes such as Environment Canada DC3. In the Convair 580 it can be operated from altitudes of 500 ft to 25000 ft and on a DC3 up to 10000ft. **CATSI System -** The Compact ATmospheric Sounding Interferometer (CATSI) is a passive infrared system designed for the standoff detection of chemical vapours. Its differential detection capability (U.S. patent) provides two unique features for a field-deployable instrument. CATSI maintains a constant calibration, thereby providing reliable quantitative measurements over a long period of time. Secondly, it can perform the real-time optical subtraction of the background signal from the target signal without the need for extensive calculations. Supported by unique acquisition software (called GASEM), CATSI is capable of on-line chemical vapour identification based on the spectral emission signatures of gases measured in the infrared region from 7 to 14 µm. CATSI is a tripod-mounted portable instrument (40 kg), with a single FOV detector (9 mrad) and full pointing capability.
GCS Research

L M T Blue Rose or Tripwire (System not sensor) – A detection, classification, location, and tracking system that has been recently de-classified. It is now in full-scale development as a result of a licensing agreement between the Naval Undersea Warfare Center (NUWC), Newport, RI, which invented the sensor technology, and GCS Research of Missoula, MT, which is further developing and commercializing it.

The patented surveillance system, known as Blue Rose, was developed by the Navy to locate and track nearby events by sound. It employs highly sensitive sensors, control and measurement electronics, and buried optical fiber. The Blue Rose system was originally designed to provide safety and security for ships, infrastructure, and personnel in and around the marine environment. It is currently in place at the NUWC's Newport facility.

The resulting system, code-named Tripwire™, can accurately pinpoint the location of a remote acoustic event such as a human or animal footstep, or the movement of an airborne or ground-based vehicle. It can also identify the source of the acoustic event and track its movements. These advancements put an important new information tool in the homeland security arsenal for border patrolling and also provide a system that can aid in high value critical infrastructure protection (CIP).

Currently, GCS Research has entered into a follow-on R&D agreement with the Navy to expand upon the classification capabilities of the technology as well as other next-phase enhancements. To assist with commercial production capability, GCS Research has selected S&K Electronics in Ronan, MT as its manufacturing partner to build the core Tripwire components and integrate the solution with SKE's advanced DSP. GCS Research is actively integrating Tripwire capabilities with on-going DoD and DHS projects.

Table 3. Future Border Surveillance Technology

Border Surveillance Technologies
Lockheed Martin
A L M T High Altitude Airship (System not the sensor) – This updated concept of a proven technology takes lighter-than-air vehicles into a realm that gives users capabilities on par with satellites at a fraction of the cost. Its utility as a mobile, re-taskable, high-altitude, geostationary, long-endurance platform will span from short and long range missile warning, surveillance and target acquisition to communications and weather/environmental monitoring.
M T Operator Support Application Framework (OSAF) (System not the sensor) - Reusable open architecture software component designed to increase human-computer interface functions. OSAF can provide platform-independent core user-support functionality for console operators.
Naval Air Systems Command (NAVAIR)
M T Broad Area Maritime Surveillance (BAMS) (System not the sensor) - The BAMS UAV is being developed to provide persistent, maritime surveillance and reconnaissance capability with worldwide access. The BAMS UAV will be a multi-mission ISR system to support strike, signals intelligence, and communications relay while operating independently or in direct collaboration with other assets in the maritime environment. BAMS will operate at altitudes over 40,000 feet, above the weather and most air traffic to conduct continuous open-ocean and littoral surveillance of targets as small as exposed submarine periscopes. BAMS will be fully integrated into the joint ISR architecture, providing this information to the joint force in near real time. Long-endurance BAMS UAVs will be able to provide a continuous on-station presence at ranges of 1000-3000 nautical miles from the launch point. BAMS will thus play a key role in providing the commander with a persistent, reliable picture of surface threats while minimizing the need to put manned assets in harms way to execute surveillance and reconnaissance tasks.
Joint Multi-Mission Electro-Optical System (JMMES) - Provides an automated processing and targeting capability for Joint, Coalition, and Interagency wide-area surveillance needs, leveraging

advanced sensors in a common turret compatible with a variety of aircraft. Addresses operators need to detect, classify, identify, and track camouflaged, concealed objects and other high-interest targets fast enough to support tactical operations and Homeland Security missions. The project is a continuation of R&D efforts that will incorporate improvements to the precursor LASH (Littoral Airborne Sensor-Hyperspectral) and the existing EPAS (Electro-Optic Passive ASW System) system to extend present antisubmarine warfare capabilities into new missions for mine countermeasures, maritime interdiction operations, surface warfare, search & rescue, illicit crop detection, and marine mammal mitigation. It is anticipated that the current hardware configuration of EPAS will be redesigned and prototypes modified and constructed to improve search rate capabilities and the acceptance of a wider range of military/civilian aircraft such as fixed winged, helicopters, airships and unmanned aerial vehicles. Software improvements will also be made to incorporate new target and clutter characteristics. Test and evaluation support will be provided to demonstrate to Combatant commands and international users the value of the JMMES system under operational conditions and circumstances.

Northrop Grumman

L T GSA Millennia (System not the sensor) - This contract was awarded in August, 2006 valued at $33.7M over five years. The Northrop Grumman team design, develop, test, and install a surveillance solution to secure more than 40 official border crossings along the 1,900-mile US border with Mexico, from San Diego, Calif., to Brownsville, Texas. The company will also train personnel. The team will also design and implement four regional command centers to monitor security systems at each port of entry. These centers will allow designated personnel to survey port perimeters, secured areas, and the interactions between CBP personnel and the public at these critical facilities. The security solution includes surveillance, communications, video analytics, network and IT components, and data archival capabilities. Northrop Grumman's team includes New Technology Management, Inc., Reston, Va.; CLMS, LLC, Arlington, Va.; and GRW, Inc., Muskogee, Okla.

Raytheon Company

A M T High-Frequency Surface Wave Radar (HFSWR) (System not the sensor) – HFSWR is a rapidly-deployed, low-cost system designed to detect and track ships and low-flying aircraft to beyond the 200 nautical mile limit. Raytheon and the DoD's CTDPO (Counterdrug Technology Development Program Office) recently began demonstrating Raytheon's new technology HFSWR (High-Frequency Surface Wave Radar) for reliable detection of small maritime vessels and low-flying aircraft in support of a critical mission need to protect the littoral waters of the United States against narcotic traffickers or other trans-national threats.

A L M T Canada's East Coast Surveillance System (System not the sensor) - Raytheon Canada and its partners are currently under contract to develop an IMS system on the East Coast of Canada.

Table 3. Future Border Surveillance Technology

Border Surveillance Technologies

U.S. Army Research, Development and Engineering Command (RDECOM) Communications and Electronics Research, Development and Engineering Center (CERDEC) Night Vision and Electronic Sensors Directorate (NVESD).

L A T **Sensors:** Research and development continues today on image intensifiers in the areas of longer wavelength spectral response, higher sensitivity, larger fields of view, increased resolution, advanced displays and image fusion. Present research and development in cooled thermal imaging are pursuing multi-spectral imaging, improved sensitivity and resolution, and embedded signal processing to aid the soldier in target acquisition missions. Current uncooled research is directed at smaller size packages and power consumption with lower cost and increased sensitivity, resolution and field of view. Small, palm-sized uncooled thermal imagers are now available. Laser devices have been developed by NVESD that emit coherent monochromatic electro-magnetic radiation in the visible, near infrared and short, mid and long wavelength infrared. Lasers are used for range finding to targets, target designation for seekers, laser radar, illumination of targets, detection of chemical/biological clouds and jammers for electro-optical sensors, such as those used in missile seekers. Current laser research is directed toward new laser materials, laser diode arrays for efficient pumping of solid state lasers, devices for converting emitted laser wavelength to other wavelengths, multi-functional lasers, eyesafe lasers and innovative laser source configurations.

The sensors on the left on the title page are called Remote Observation and Confirming Sensors (ROCS). They were developed at NVESD to provide remote unattended monitoring, day/night imaging of activity along paths, cave entrances, airfields, sensitive facilities, perimeters, urban environments, or other locations of interest. The camera once triggered by unattended ground sensors (seismic or passive infrared) transmits imagery of the intruder to a remote base station for confirmation. The technology is fabricated for various customers to address contingency needs and isn't currently part of any program of record.

The Rapid Aerostat Initial Deployment (RAID) system was developed by Raytheon for NVESD. RAID is a force protection sensor on an elevated platform (aerostat, tower, or mast); provides 24/7, 360 degree, hi-resolution, visual coverage. Combats IED, mortar, rocket propelled grenade, and small arms attacks. Its sensors consist of a Day/Night sight, laser rangefinder, spotting scope. Detection Ranges: 13km personnel, 20km vehicles.

Recon/Optical, Inc

A M T Advanced Technology (Hyperspectral) - The latest technology ROI is developing. Instead of imaging targets in just two light spectra, visible and IR, new camera systems will image in dozens, perhaps hundreds, of spectra, using airborne imaging spectrometers. These hyperspectral cameras are becoming more practical as higher speed electronics, precision stabilization and pointing, sophisticated diffraction optics, and larger focal plane arrays (FPA) are becoming more available and affordable.

FOREIGN BORDER SURVEILLANCE SYSTEM/PRODUCT MANUFACTURERS

This section identifies foreign border surveillance companies a brief description of their systems/products and the applicable environment(s) for each. The environments are labeled and color coded; A for air is light blue, L for land is green, M for maritime is dark blue, and T for technology is brown.

Table 4. Foreign Manufacturers: Surveillance Systems/Products or Technology

ALMT/System/Product Name
BAE Systems PLC
BAE Systems plc is company registered in England and Wales. BAE Systems, Inc., the US subsidiary of BAE Systems plc, is headquartered in Rockville, Maryland, and is responsible for developing BAE Systems' trans-Atlantic business, relationships with the US Government, administration of BAE Systems' Special Security Agreement, and managing its US based operating groups. A M BAE Integrated System Technologies (Insyte) - has developed solutions to address the full spectrum of Homeland Security issues. • Deployable Surveillance Unit (DSU) - employs a flexible, cost-effective C2 system which provides a single unified surveillance picture and enables the integration of a wide range of sensors, including EO/IR cameras, radar, unattended ground sensors, and swimmer detection systems. System mobility provides a mobile integrated surveillance system for monitoring borders and protecting key assets. • High-Frequency Surface-Wave Radar (HFSWR) offers low-cost performance over-the-horizon surveillance capability with flexible deployment to provide long range early-warning against surface vessels and low-flying aircraft. • Spider Command and Control System a highly flexible C2 system at the core of Insyte's DSU. BAE Electronics & Integrated Solutions (E&IS) designs, develops, produces, and supports electronic systems and subsystems for military and commercial applications. Based in Nashua, NH, E&IS has employees at more than 50 sites in the US, the UK, and Israel. E&IS' capabilities include electronic warfare and self-protection systems; surveillance and intelligence; aircraft controls and avionics; sensors and precision targeting systems; communication, navigation, identification, and reconnaissance systems; enterprise solutions and information management for the defense and intelligence communities; mission-specific software and geospatial exploitation products; and rapid C4ISR prototyping. Sensor Systems', a division of EIS, products include: A AARS (Advanced Airborne Reconnaissance System) can be configured for various manned and unmanned aircraft. It is a dual band system providing three fields of view for long and medium range reconnaissance as well as overflight missions. It has a focal length of 120 inches and delivers excellent high altitude reconnaissance in day or night operations. Although flown on a USAF F-16 at altitudes up to 50,000 feet, a prototype was also flown on a P-3 Orion in 2001. The CP-140 Aurora, a long-range maritime reconnaissance, anti-submarine warfare aircraft for the Canadian Armed Forces, is based on the P-3 Orion airframe. During the flight trials at Eglin, AARS captured images of tri-bar resolution targets, military vehicles and geographical targets from standoff ranges greater than 25 miles.

Table 4. Foreign Manufacturers: Surveillance Systems/Products or Technology

ALMT/System/Product Name
BAE Systems PLC
A LORHIS (Long Range Hyperspectral Imaging System) can be configured for either manned or unmanned aircraft to automatically detect and identify camouflaged, concealed and deceptive targets as well as chemical gas plumes invisible to the naked eye, day or night. Through the use of image chipping, bandwidth is significantly reduced and only actionable information is presented to an image analyst. By eliminating unnecessary information and positively identifying targets according to their hyperspectral signature, LORHIS supports the goal of a single digit sensor-to-shooter cycle. LORHIS is revolutionizing conventional reconnaissance by supporting the goal of a sensor-to-shooter (find, fix, track, target, engage and assess) cycle time measured in single digit minutes, rather than hours. Potential applications include: • Rapid precision targeting • Combat assessment • Counter proliferation • Broad area coverage • Real-time analysis • Terrain analysis **Note**: On 03 April 2007 BAE Systems and Raytheon Company announced they formed a team to pursue opportunities under the Distributed Common Ground System-Navy (DCGS-N) program. The DCGS-N Enterprise Team will design and demonstrate a Web-based intelligence, surveillance, and reconnaissance (ISR) and targeting capability to support naval operations and other US government agencies, military services, and US allies for a wide range of missions. The team also will research and offer suggestions on how best to transition these functions into the baseline DCGS-N program.
Cedip Infrared Systems (can't access web page)
A French company that provides world class infrared imaging cameras and systems for high end applications. A M PHAROS LRN - is a high-resolution gyrostabilised multi-sensor platform specifically designed to provide top quality surveillance imaging in all visibility conditions (day or night). Features a two axis stabilized platform equipped with a long range 640 x 512 pixels cooled thermal imager to give night capabilities and a color CCD camera with powerful zoom for daytime operation. The head, engineered to meet harsh marine environment and IEC60945 standards, includes wash/wiper system and internal heater to prevent icing on windows. **Note:** The General Directorate of French Customs have selected the Pharos LRN surveillance sensor from Cedip Infrared Systems to equip its two new coastguard patrol craft currently still in construction.
Chelton Microwave
A US subsidiary of Chelton Ltd., a division of Cobham PLC , a UK aerospace and defense company. As a subsidiary of a foreign corporation operates under a Special Security Agreement (SSA) with the US DOD and in conjunction with the Committee on Foreign Investment in the US (CFIUS). A L M T Atlantic Positioning Systems (APS) one of Chelton Microwave's divisions, includes surveillance products. Atlantic's product line consists of the SPS-500, SPS-1000, SPS-2000 and SPS-4000 series positioners, which vary primarily in size and torque capability. The design and construction techniques are largely similar and constitute a rugged COTS design suitable for land, marine, and airborne gimbal applications. APS' integrated systems are ideally suited for pointing optical sensors, lasers, radars, and communications antennas and are designed for ground stabilization, shipboard stabilization and airborne stabilization applications. Homeland Security / Force Protection -- APS provides fully integrated turnkey positioning systems to support an array of homeland security applications. • Multi-Sensor Surveillance • Long Range Surveillance • Remote Monitoring/Sensing • Border and Coastal Surveillance • Covert and Portable Surveillance

Table 4. Foreign Manufacturers: Surveillance Systems/Products or Technology

ALMT/System/Product Name
Chess Dynamics
Chess is a principal UK and overseas defense subsystem supplier to Army and Navy applications. L Vehicle Mounted Radar Platform - Chess are fast and efficient in the design and development of specialist positioning and tracking multi-axis platforms. Chess has all the skills needed to produce high quality, reliable products on time and to cost. L Electro-optic Platforms and Surveillance Systems - A range of very small lightweight, but rugged, geared pan and tilt positioners that are ideally suited for optical security and surveillance operations. With no effective backlash, this system offers good payload carrying capability and performance for all types of fighting vehicle applications. L M Eta2 Dual Axis Director Mount - This system is easily configured to suit single sensor payloads. The drive system can be adapted for different gear ratios and motor types from single stepper motors to full velocity and position-controlled servo drives. The geared Eta system is ideally suited to surveillance and security applications where speed and accuracy is important. L M Zeta2 Dual Axis Director Mount - The Zeta positioner is an extremely high accuracy, rugged, backlash-free geared system with outstanding performance. Suitable for heavy payloads in exposed environments. Ideal for all military land and sea applications. L M Iota2 Dual Axis Director Mount - high dynamic performance and positional accuracy for land, vehicle and sea gyro stabilized electro-optic applications. L Piranha range of CCTV Cameras and IR Cameras - economical, robust and ideal for vehicle mounting or for fixed or portable security monitoring. Options include: • color, monochrome and lowlight configurations • PC/laptop connection using Firewire RS232/422/485 interfaces • Standard video outputs
Controp Precision Technologies
A privately owned Israeli company A L M **Stabilized Payload Systems-** Daytime Applications • D-STAMP - Day Stabilized Miniature Payload - a miniature, lightweight electro-optical, stabilized, payload for surveillance and reconnaissance on a variety of different platforms: small UAVs, small manned aircraft, aerostats tactical small observation balloons, manned and unmanned ground vehicles, manned and unmanned maritime vehicles. • ESP 600C High Resolution Color Observation Payload - a sophisticated very high resolution, lightweight, stabilized daylight Color Observation system designed primarily for scout helicopters, light reconnaissance aircraft, observation balloons and UAV's. • ESI-1 (3CCD) Stabilized Camera System – a unique light weight stabilized camera system provides high-resolution imagery from a three gimbal, gyro stabilized, daylight aerial camera. The system combines a broadcast camera with high quality precision stabilized turret, in a very cost effective solution, that can be used for various applications including surveillance. Day/Night Applications • DSP1 Dual Sensor Stabilized Payload - a compact, high resolution Day/Night observation system configured for use on helicopters, UAV's, light reconnaissance aircraft and marine patrol boats. • MSSP-1 Multi Sensor Stabilized Payload - a rugged Day/Night Surveillance system especially configured for use on attack helicopters • MSSP-3 Maritime Observation Payload - a Day/Night observation system especially designed for Maritime Patrol Aircraft and patrol boats.

Table 4. Foreign Manufacturers: Surveillance Systems/Products or Technology

ALMT/System/Product Name
Controp Precision Technologies (Continued)
L M **Intruder Detection Systems** • CEDAR- Automatic Intruder Detection System (Modular) - a highly sophisticated electro-optical panoramic Intruder Detection System which automatically detects motion in a wide panoramic view. CEDAR has two modes of operation: Panoramic scan mode for intruder detection and Observation mode with live video for intruder recognition and identification. The scan sector can be selected in both, azimuth and elevation axes. • RAPID- Real Time Automatic Intruder Detection System - a ruggedized real-time panoramic intruder detection system which automatically detects motion in a wide panoramic view. Performs completely passive Electro-Optical panoramic detection scans. The scanned sector can be selected between 5° to 180°. • SPIDER- Stabilized Automatic Intruder Detection System - a highly sophisticated, stabilized, passive, real-time, electro-optical, panoramic Intruder Detection System which automatically detects motion in a wide panoramic view and may be installed on a vibrating mobile platform and/or high mast • SGA-2- Stabilized Gimbal Assembly - a two-axis generic Gimbal Assembly, stabilized in azimuth and in elevation. It is designed to carry an optronic payload made by CONTROP or made by any other manufacturer.
Elbit Systems Ltd.
L Border and Site Security Systems (BSS) - Elbit Systems' Border and Site Security (BSS) systems are fully integrated solutions presenting real time pictures of developing events, operating with minimal human intervention and rapid response time. Attempts to cross the secured area trigger an alarm at the command post. Intervention teams are dispatched armed with critical comprehensive data on the breaching attempt (exact location and images). A L BCR 2000 - Elbit Systems was selected by the Israeli Police Force to provide a border control system deployed over all airport, sea and land entry points. The system, called BCR 2000, fulfills the special needs and operational requirements of a wide range of potential users worldwide. BCR 2000 benefits from Elbit Systems' extensive experience in integrating Command, Control and Communication for defense customers. A L M T Border Control and Management System (BCMS) - is a state-of-the-art system that supervises and controls all border movements. Elbit Systems' BCMS is an automated, extremely efficient solution designed to detect and thwart border intrusion attempts, identify forged documents, prevent illegal immigration, stop smuggling, combat cross-border crime, as well as to monitor and administer passengers, vehicles and cargo. In operational use by military and police forces, governments, border and coast guards and security companies, Elbit Systems' security solutions have time and again proven their ability to increase effectiveness in monitoring and controlling military bases, high-risk installations, airports, seaports, stationary or mobile land-border checkpoints and other security-sensitive areas in real-life scenarios.

Table 4. Foreign Manufacturers: Surveillance Systems/Products or Technology

ALMT/System/Product Name
ELTA Systems Ltd (Subsidiary of Israel Aerospace Industries)
A L M EL/I-3300 - Integrated Border Protection System components include: • **Command and Control Center -** gathers and fuses information from all sensors and informs the law enforcement units, in real time, on threat location. • **UAV** - Unmanned aircraft are used to patrol large areas and track moving targets as support to law enforcement units. • **Aerostat** - is used for air-to-surface surveillance, by radar and E/O, and is capable of overcoming most Line-of-Sight obstacles of the ground-to-ground surveillance systems. • **EL/M-2226 - Advance Coastal Surveillance Radar** - Optimized too detect small targets in rough seas. Used to prevent illegal immigration and penetration of smugglers and terrorists. • **EL/M-2128 - Miniature Movement Detection Radar** - Detection ranges * Persons 8 km * Vehicles 25 km. Used mainly for ground surveillance. • **EL/M-2129 - Medium Range Movement Detection Radar** - Detection Ranges * Persons 14 km * Vehicles 60 km. Used mainly for tactical intelligence and battlefield surveillance. • **EL/M- 2140NG - Long Range Movement Detection Radar** - Detection ranges * Persons 14 km * Vehicles 60 km. • **EL/M-2106NG - Point Defense Air Surveillance Radar** -Detection Ranges up to 40 km. Detects low flying aircraft, hovering helicopters and gliders. • **Perimeter Fence** - Used as an obstacle to delay entrance to protected areas. Sensors mounted on the fence issue alert regarding penetration location. • **Day and Night Electro-Optical Sensor** - Can be slaved to radar detection. Used for identification purposes. Day sensor: CCD TV. Night Sensor FLIR
Kollsman Inc.
Kollsman is a US subsidiary of Elbit Systems A L CoMPASS - Kollsman's CoMPASS is a stabilized, high performance electro-optical system used for observation, surveillance, tracking and targeting under battlefield conditions. The flexible configuration may include up to five sensors with other options: 3rd generation, MWIR FLIR; Day channel with zoom camera; laser - optional choice between 2 types of eyesafe rangefinders or 2 types of laser target designators; laser NVG compatible pointer; and inertial navigation system with sensor on gimbal. Kollsman is also a team member of the Boeing-led SBI. L Long-Range Reconnaissance and Observation System (LORROS) - LORROS provides long-range daytime and night-time surveillance from a remote surveillance control and display center. Applications include: Border Surveillance, Coastal Observation & Surveillance, Site Security, Force Protection, Suspicious Activities (Drug, Terrorism) Reconnaissance, Artillery Spotting & Ranging. The LORROS sensor unit can be mounted on vehicles or installed on rooftops, on erectable towers, or on tripods and remotely controlled from an existing or new surveillance control center, or via a ruggedized portable control unit. The sensor unit can be remoted up to 100 meters from the control unit or several kilometers via fiber link. Wireless microwave links are possible L Automatic Detection IR System (ADIR) - ADIR provides affordable, state-of-the-art, 24/7, infiltration detection along unsecured perimeters. Using passive infrared sensors that are panoramically scanned, wide areas and perimeters around facilities are provided security protection. Multiple sensors can be linked to a remote security surveillance and control center, to provide complete surveillance coverage of any facility. L Secure Remote Observation System (SEROS) - SEROS is an affordable, day/night medium range observation system for perimeter defense or area surveillance. Its modular construction allows it to be easily adopted for mounting to various fixed installations, or telescoping vehicle masts. It can be integrated with perimeter intrusion detection systems such as electronic fences or Kollsman's Automatic Detection IR System (ADIR) to provide ID of intrusion activity.

Table 4. Foreign Manufacturers: Surveillance Systems/Products or Technology

ALMT/System/Product Name
Rheinmetall Defence Electronics
L T Network Centric Security System (NCSS) - consists of a chain of sensors along a border or other virtual line. These include ground sensors and radar systems as well as stationary and mobile electro-optical sensors of the type Rheinmetall supplies to the military. How the sensors are positioned depends on the topography and the operational structure of the border guard units. Ground sensors and radar systems are mainly deployed in an intruder alarm and tracking role. The primary mission of the electro-optical sensors is to identify illegal border crossers and determine whether the intruder is a human or animal. All of the sensors are connected online to the operations centre. Instantaneous communication is the key to success in an integrated border security system. Incoming data from the sensors is analyzed in the operations centre with help of intelligent systems.
Thales UK (A company of Thales Group)
A L M T Surveillance of Borders, Coastlines, and Harbours (SOBCAH) - will tackle the European border surveillance problem and is intended to make a substantial breakthrough in the system engineering of complex systems (systems of systems). The new European border is formed of 6,000 km of land borders and 85,000 km of coastlines, with possibilities for access for illegal migrants, drug smugglers and terrorists. By establishing an advisory board encompassing the dispersed community of land and sea borders security stakeholders, this project will investigate every possibility to increase the effectiveness, connectivity and reactivity of borders and harborss. The consortium is led by the Italian Galileo Avionica SpA, a Finmeccanica company, and is composed of 16 partners from 10 countries. Within the project, Thales UK is leading a work package to design the overall architecture framework of a system of systems capable of meeting SOBCAH's requirements. The work package will assess existing & planned systems, which must interact with the proposed system. It will define sub-systems in sufficient detail to act as the foundations for the demonstrations to be constructed within the SOBCAH project and for future security oriented situational awareness projects.

SOURCES

The sources are contained in the document as hyperlinks.